

CLAIMS

1. An apparatus for detecting a stall condition of a stepping motor of the type which includes at least first and second coils and a rotor having a plurality of magnetic poles therearound, said apparatus comprising;

a current generator for alternately supplying drive currents to said first and second coils causing the rotor to step, each of said first and second coils generating signals when transitioning from a driven state to a non-driven state, said signals resulting from motion of said rotor;

an integrator having an input coupled to receive said signals and for generating an integrated version thereof; and

a comparator coupled to said integrator for comparing said integrated version with a predetermined threshold to detect the stall condition.

2. An apparatus according to claim 1 wherein said signals are of alternating polarity.

3. An apparatus according to claim 2 further comprising a rectifying circuit having an output coupled to said integrator for correcting the polarity of said signals.

4. An apparatus according to claim 3 further comprising a blanking circuit for masking an initial portion of each of said signals, said initial portion corresponding to the time it takes for the drive current in each of said first and second coils to substantially decay.

5. An apparatus according to claim 4 further comprising a control circuit coupled to said current generator and to said rectifying circuit.

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6. An apparatus according to claim 5 wherein said current generator comprises a first switching circuit coupled to said control circuit and controlled thereby.

7. An apparatus according to claim 6 wherein said rectifying circuit comprises a second switching circuit coupled to said control circuit and controlled thereby.

A' 8. An apparatus according to claim 7 wherein said blanking circuit comprises a third switching circuit coupled to said control circuit and controlled thereby.

9. An apparatus for detecting a stall condition of a stepping motor of the type which includes at least first and second coils and a rotor having a plurality of magnetic poles therearound, said apparatus comprising;

current generating means for alternately driving said first and second coils causing said rotor to perform a stepping rotation, each of said first and second coils generating a back emf voltage signal when transitioning from a driven to a non-driven state due to the rotation of said rotor;

integrating means coupled to receive said back emf voltage signals to generate an integrated version thereof; and

detecting means coupled to said integrating means for determining if said integrated version is representative of the stall condition.

10. An apparatus according to claim 9 wherein said back emf voltage signals are of alternating polarity.

11. An apparatus according to claim 10 further comprising rectifying means coupled to said integrating means for correcting the polarity of said back emf voltage signals.

12. An apparatus according to claim 10 further comprising blanking means for masking a predetermined initial portion of each of said back emf voltage signals, said predetermined portion corresponding to the time it takes for drive current in each of said first and second coils to substantially decay.

13. An apparatus according to claim 9 wherein said detecting means comprises a comparator for comparing said integrated version with a predetermined threshold.

14. An apparatus for displaying a measure of a variable, comprising;

- a stepping motor, comprising;
 - at least first and second coils; and
 - a rotor having a plurality of magnetic poles therearound;
- a display actuator coupled to said rotor for movement by said rotor to reflect a measure of said variable;
- a current generator for alternately supplying drive currents to said first and second coils causing said rotor to rotate by an amount indicative of the measure of said variable, each of said first and second coils generating signals when transitioning from a driven to a non-driven state, said signals resulting from the motion of said rotor;
- an integrator having an input coupled to receive said signals for generating an integrated version thereof; and
- a detector coupled to said integrator for determining if said integrated version is representative of a stall condition.

15. An apparatus according to claim 14 wherein said signals are of alternating polarity and further comprising a rectifying circuit coupled to said integrator for rectifying said signals.

16. An apparatus according to claim 15 further comprising a blanking circuit for masking a predetermined initial portion of each of said signals.

17. An apparatus according to claim 14 wherein said detector comprises a comparator for comparing said integrated version with a predetermined threshold to detect the stall condition.

18. A method for detecting a stall condition of a stepping motor of the type which includes at least first and second coils and a rotor having a plurality of magnetic poles therearound, said apparatus comprising;

alternately driving said first and second coils to with drive signals to cause said rotor to rotate, each of said first and second coils generating emf signals when transitioning from a driven to a non-driven state, said emf signals being caused by movement of said rotor;

integrating the emf signals; and

monitoring the integrated emf signals to detect a stall condition.

19. A method according to claim 18 further comprising the step of rectifying said emf signals prior to integration.

20. A method according to claim 19 further comprising the step of masking an initial portion of each of said emf signals corresponding to the time it takes for the drive signals in each of said first and second coils to substantially decay.